

## CLAIMS

What is claimed is:

1. A door assembly, comprising:
  - an interior panel and an exterior panel;
  - a semi-rigid barrier sheet disposed between said interior and exterior panels;
  - one or more features formed in said semi-rigid barrier sheet accommodating components housed between said semi-rigid barrier sheet and said interior and exterior panels including bosses for mounting said semi-rigid sheet to said assembly; and
  - a plurality of resonance frequency diffusion (RFD) reliefs formed in said semi-rigid barrier sheet that diffuse sound waves directed toward said semi-rigid barrier sheet.
2. The door assembly of claim 1 wherein said semi-rigid barrier sheet is formed of a water resistant material.
3. The door assembly of claim 1 wherein said semi-rigid barrier sheet is formed of a thermally formable material.
4. The door assembly of claim 3 wherein said thermally formable material is selected from a group consisting of a thermoplastic polymeric material and a thermoplastic olefin (TPO).

5. The door assembly of claim 4 wherein said TPO comprises a cross-linked polypropylene and polyethylene blend.
6. The door assembly of claim 1 further comprising a linear low density polyethylene film and a silicon-based coating applied to a surface of said semi-rigid barrier sheet.
7. The door assembly of claim 1 further comprising a layer of sound attenuation material that absorbs non-diffused sound waves that pass through said semi-rigid barrier sheet.
8. The door assembly of claim 1 further comprising a pressure sensitive adhesive material that adhesively engages said semi-rigid barrier and said panel assembly.
9. The door assembly of claim 1 wherein said RFD reliefs are semi-spherical in shape.
10. The door assembly of claim 1 wherein said RFD reliefs comprise a plurality of concave shapes facing said interior panel.

11. The door assembly of claim 1 wherein said RFD reliefs comprise a plurality of concave shapes facing said exterior panel.

12. A vehicle panel assembly, comprising:

an exterior panel assembly that defines a cavity;

a trim panel attached to said exterior panel assembly; and

a molded water-shield disposed between said trim panel and said exterior panel assembly, comprising:

a semi-rigid barrier sheet;

one or more features formed in said semi-rigid barrier sheet accommodating components housed between said semi-rigid barrier sheet and said cavity including bosses for mounting said semi-rigid sheet to said assembly; and

a plurality of resonance frequency diffusion (RFD) reliefs formed in said semi-rigid barrier sheet that diffuse sound waves directed toward said semi-rigid barrier sheet.

13. The vehicle panel assembly of claim 12 further comprising a glass sheet that is slidably supported by said exterior panel assembly.

14. The vehicle panel assembly of claim 12 wherein said semi-rigid barrier sheet is formed of a water resistant material.

15. The vehicle panel assembly of claim 12 wherein said semi-rigid barrier sheet is formed of a thermally formable material.

16. The vehicle panel assembly of claim 15 wherein said thermally formable material is selected from a group consisting of a thermoplastic polymeric material and a thermoplastic olefin (TPO).

17. The vehicle panel assembly of claim 16 wherein said semi-rigid barrier sheet is formed of a thermoplastic olefin elastomer (TPO).

18. The vehicle panel assembly of claim 17 wherein said TPO comprises a cross-linked polypropylene and polyethylene blend.

19. The vehicle panel assembly of claim 12 wherein said molded water-shield further comprises a linear low density polyethylene film and a silicon-based coating applied to a surface of said semi-rigid barrier sheet.

20. The vehicle panel assembly of claim 12 further comprising a layer of sound attenuation material that absorbs non-diffused sound waves that pass through said semi-rigid barrier sheet.

21. The vehicle panel assembly of claim 12 wherein said molded water-shield further comprises a pressure sensitive adhesive material that adhesively engages said semi-rigid barrier and said exterior panel assembly.

22. The vehicle panel assembly of claim 12 wherein said RFD reliefs are semi-spherical in shape.

23. The vehicle panel assembly of claim 12 wherein said RFD reliefs comprise a plurality of concave shapes facing said trim panel.

24. The vehicle panel assembly of claim 12 wherein said RFD reliefs comprise a plurality of concave shapes facing said exterior panel assembly.

25. A barrier panel comprising a body of semi-rigid moisture barrier material having a relief pattern comprising a plurality of raised regions relative to a plurality of lower regions, said relief pattern arranged to diffuse sound waves directed toward said barrier panel.

26. The barrier panel of claim 25 wherein said raised regions comprise protrusions of said material outward from a surface of the body.

27. The barrier panel of claim 25 wherein said raised regions comprise material deposited on a surface of said body.

28. The barrier panel of claim 25 wherein said deposited material is the same as said semi-rigid moisture barrier material.

29. The barrier panel of claim 25 wherein said body has first and second opposite major surfaces, a first group of said raised regions is disposed at said first surface and a second group of said raised regions is disposed at said second surface.

30. The barrier panel of claim 25 wherein each of said raised regions of said first group is defined by a peak at said first surface and said peak defines a valley at said second surface, said valley constituting one of said lower regions.